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ABSTRACT

This paper reports the results of a study that used Confirmatory Factor Analysis techniques to analyze data collected using the "Faculty at Work" (Robert T. Blackburn and Janet H. Lawrence) survey instrument in an effort to untangle effects and confirm the factor composition of theoretical constructs used as the basis for this questionnaire, including socio-demographic variables, self-knowledge, environmental conditions, and social knowledge. This study provides initial findings about the factor structure of the theoretical variable, "social contingencies" (i.e., life events such as domestic strife or death of a family member), and its impact on publishing output. Results of the construction of a new section of the questionnaire concerning the campus information environment and identification of the factors that may comprise that theoretical variable are also reported. Four basic components of a faculty member's information environment were identified to serve as theoretical variables comprising the campus information environment: personal information stores; library information stores and services; information technology and networking; and the faculty member's assessment of the ease of use, personal enjoyment, and utility of information technology. The data confirm and refine many of the latent variables used as the basis for the "Faculty at Work" questionnaire. (Contains 19 endnotes and 5 data tables.) (MES)

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FACTORS RELATED TO FACULTY PUBLISHING PRODUCTIVITY

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Introduction

"If the core activity of the scholarly and academic professions is the advancement of knowledge, the criterion for determining who does and who does not belong to these professions is professional publications, or sometimes scholarly reputation." Although Light goes on to allow that several other criteria could also be used, he returns to publication as the primary measure of professionalism within academe. If publication is the sine qua non of membership in the scholarly community, administrators and others responsible for managing a university's resources should be intensely interested in gaining a better understanding of the factors that support faculty in their efforts to perform and publish research.

Research into scholarly publishing productivity has moved beyond analyzing solely the correlation that directly measured variables such as institutional size, previous publication, and personal demographic and career related factors, such as age and rank, have on the number of articles published to include analysis of the role played by psychological and other latent variables in faculty productivity.[1] Fox conducted a literature review of the early work on variables that influence publication productivity among scientists in which she categorized the factors into three major groups: individual-level characteristics (including psychological traits), environmental location (including institutional prestige of both one's employer and one's graduate degree), and feedback processes (such as peer recognition or citation). Fox's conclusion was that: "While certain variables from each perspective do correlate strongly with productivity no one study or perspective explains the vast variation in...productivity, and the challenge for productivity studies lies in the capacity to combine perspective and untangle effects."[2]

Combining perspective and untangling effects, however, is not an easy task. It requires the use of highly sophisticated data analysis techniques as well as a well-developed survey instrument. This article reports the results of a study that used Confirmatory Factor Analysis techniques to analyze data collected using the *Faculty at Work* survey instrument in an effort to "untangle effects" and confirm the factor composition of theoretical constructs used as the basis for this questionnaire. The study also presents results of the construction of a new section of the questionnaire concerning the "campus information environment" and identification of the factors that may comprise

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that theoretical variable.

Theoretical Model

Robert Blackburn and his colleagues conducted the first *Faculty at Work* survey in 1988. It "was designed to gather data on faculty perceptions of their work environment, their own competency and efficacy as faculty members, their assumptions about teaching, and their research, teaching, and service behaviors."[2] Survey items were based upon theoretical constructs from the higher education research literature related to important personal and environmental properties as well as upon extensive interviews conducted with faculty on campuses representing a diverse set of environments. Four thousand four hundred faculty members responded from a multi-disciplinary sample that was drawn to reflect the national distribution of faculty by Carnegie Institutional Classification type.

In developing the instrument for *Faculty at Work*, Blackburn and his colleagues have built a theoretical framework within which to posit groups of variables. Need theory, life-stage theory, socialization theory, and reinforcement theory were used to describe possible relationships among correlates. The various pieces of the model were linked together within a cognitive motivation framework that proposes that "the manner in which people differentially assess their personal abilities and interests interacts with their perceptions of the organization's priorities (what it supports) and causes them to engage extensively in some activities and less frequently in other activities"[3] (INSERT FIGURE 1)

The theoretical model upon which this study is based, represented in Figure 1, is a modified version of the model used by Blackburn and Lawrence. The theoretical bases for the structural relationships among the constructs draw heavily upon cognitive motivation theories and social cognition theories. Underlying premises for this framework include:

> "First, academic institutions are achievement laden environments in which the evaluation of faculty, student and administrator performance is ongoing. Second, faculty use assessments of themselves and their social contexts to make logical decisions about their actions. However, not all decisions require the same level of detailed situation analysis. Third, experience over time leads individuals to modify their understanding of their work environments as well as their self-images. These changes can affect the subjective incentive value of different facets of work and, consequently a faculty member's level of engagement in different activities can shift. Fourth, some types of self-referent thought and perceptions of the work environment are more enduring than others that change frequently on the basis of personal feedback and vicarious experience."[4]

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Socio-Demographic variables are the exogenous personal variables, including gender, race, and chronological age. These variables are first in the model because of their ability to influence an individual's access to career opportunities and the development of personal values and goals.[5] Professional Career variables include: the graduate school from which one received a Ph.D. (with its attendant socialization process concerning the respective values of research and teaching), one's discipline, prior publication record, career age, current rank, tenure status, type of employing institution and one's administrative position within that university. Empirical evidence supports the notion that "accumulated advantage," or the "Matthew effect,"[7] i.e. the tendency for people who have early recognition to receive increasingly more resources and opportunities for further recognition and publication, can mediate many other effects, especially those of chronological age.[8] Other career variables have equally significant effects on publishing output that, in general, overshadow the effects of socio-demographic variables.[9]

Self-Knowledge represents self-evaluations in terms of beliefs about personal and professional self-image, self-efficacy and competence. Cognitive motivation research suggests that "individuals' understanding of themselves (e.g., their self-assessed competence, personality dispositions, efficacy, etc.) predict how they perceive their environments (e.g. norms, resources, etc.) more frequently than environmental perceptions predict this self understanding."[10] The importance of self-efficacy in scholarly productivity, especially for women researchers, has been confirmed in a recent study by Brown et al.[11]

The exogenous environmental variables are denoted by the Environmental Conditions construct which represents the institution itself, its financial base, location, student body, and governance structure. Environmental Responses include reward systems, performance evaluations and (dis)incentives that faculty receive for certain behaviors.

The key construct in this model is Social Knowledge. This set of variables is a focal concept that represents the interaction of perceptions of the environment and perceptions of self that constitute the motivational basis for faculty behaviors. Blackburn and Lawrence's premise is that reinforcement, socialization, and social learning theories all support the theoretical assumption that the environment shapes an individual's perceptions of desired behavior both directly through statements of institutional goals, faculty role expectations, etc., and indirectly through rewards and other feedback on performance. Furthermore, expectancy theories, efficacy theories, information processing theories and attribution theories also lead to the proposition that individual behavior is the result of a

complex interaction between personal and work environment variables.

Behaviors are mediated by Social Contingencies. This construct is comprised of events and crises that happen within the personal environment of the individual faculty member, such as birth of a child or illness of a spouse, that affect behavior and the quality of performance/outcomes. Behaviors may have many outcomes. The outcome of primary interest in this study is scholarly publishing output, especially the publication of scholarly journal articles or books.

In this study two significant modifications to the *Faculty at Work* questionnaire as administered by Blackburn and Lawrence were made. Researchers in higher education have not yet studied the impact that variables related to events in the personal life of faculty might have on scholarly productivity although their theoretical model includes such a construct. Life events, or "social contingencies," such as domestic strife or death of a family member have been proposed by Blackburn and Lawrence[12] but no empirical evidence of the role that these variables play has been gathered. Nor has any analysis been made of the factors that may comprise this latent variable. This study provided initial findings about the factor structure of the theoretical variable "Social Contingencies" and its impact on publishing output.

Educational researchers have also tended to overlook variables in the work environment related to the campus information environment that might have relevance to scholarly publishing productivity. Although variables related to size of library or journals subscribed to have been noted in a few studies[13] there has been no systematic investigation in the literature of higher education or library and information science of factors related to information use that may affect scholarly productivity.

The impact that information technology (IT) might have upon scholarly publication rates has received attention in recent years as more universities acquire the installation base required to assess this in a meaningful way. Early investigations by Almquist[14] indicated that the scientists he studied used information technology in the subject identification and proposal development stages of research and to acquire familiarity with literature outside their own specialties. Others[15] note that the relationship of information technology is still largely unknown. Massy and Zemsky state that "so far, most IT-based academic productivity improvements have involved doing more with more."[16] To the extent that the research process may be subject to economies of scale, they assert that the widespread introduction of IT should provide heightened productivity.

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Little research on the how the "campus information environment" contributes to faculty research productivity has been undertaken. The "campus information environment" refers in this study to all the major information resources available to faculty and the mix of telecommunications, equipment, and other information services that are supported primarily by expenditures through institutional budgets. This study that is one of the first to explore what are the factors that might comprise the campus information environment.

In order to identify variables that might comprise the campus information environment the literature of library and information studies was extensively reviewed. Four basic components of a faculty member's information environment were identified to serve as theoretical variables comprising the campus information environment: personal information stores (such as personal book and journal collections); library information stores and services, including the assistance of a librarian; information technology and networking, including use of email; and the faculty member's assessment of the ease of use, personal enjoyment, and utility of information technology in his or her work. Several questions were developed, based on a review of the literature, for each of the four theoretical variables. The results were analyzed as to the strength of the factor structure of each variable and as to the variable's relationship to publishing productivity.

Data Collection and Analysis

This study was designed in part to test the structure of factors upon which the theoretical model underlying the *Faculty at Work* questionnaire is based. The faculty as a whole were considered to represent the population represented in Blackburn and Lawrence's fully generalized model for faculty productivity. The latent variables in question have been identified over time by these researchers through analysis of large, stratified sample data sets and the theoretical model represents a fully generalized model for all types of institutions and all types of faculty. This model posits no difference in the particular variables or the relationship among them, although different parameter estimates for effects within a causal, or structural, model analysis might be expected for different sub-populations. Since analysis of theoretical variables was the focus of this study rather than comparison of parameter estimates data were analyzed without subdividing respondents by gender, discipline or other criteria.

However, as a precautionary measure characteristics of the respondent pool in the main study were analyzed to assess their match to the institutional profile for faculty as a whole. Results of this comparison are displayed in

Table 1. Respondents displayed demographic characteristics highly comparable to the faculty as a whole based on information generated from a list of university mailing labels.

Questionnaires were keyed to allow the investigator to track non-respondents for a second round of distribution. The second round was distributed approximately six weeks after the first round. Total returned were n=845, or 34.2%. One explanation of the somewhat low return rate might be that the use of numbered questionnaires discouraged participation because of the fear of identification of the respondent. The use of keyed questionnaires has been criticized, especially when the questionnaire includes potentially sensitive questions, such as those related to attitudes towards colleagues and department chairs.

To test the assumption that keyed questionnaires discourage returns, the investigator numbered 50% of the questionnaires and left 50% unnumbered during the second distribution to those who had not responded to the first round. Using the mailing label list, every second address was selected to be keyed with an identifying number to maximum the random nature of numbering. If it were true that numbering discourages participation, it could be assumed that a larger percentage of unnumbered than numbered questionnaires would be returned in the second round.

Returns did not support this assumption. Of the 1858 surveys

TABLE 1. COMPARISON OF POPULATION AND RESPONDENT CHARACTERISTICS

		Population	Survey	
1.	Gender			(n=839)
	Male	74.2%	74%	
	Female	25.8%	26%	
2.	Rank			(n=849)
	Professor	41.0%	50.1%	
	Assoc. Prof.	23.8%	22.6%	
	Asst. Prof.	18.8%	20.9%	
	Other	16.4%	6.4%	
3.	Discipline			(n=830)
	Science/ Applied Sci.	55.2%	52.2%	
	Social Sci.	32.9%	36.6%	
	Humanities/ Fine Arts	11.9%	9.0%	

distributed in the second round, one hundred nineteen numbered surveys and one hundred one unnumbered surveys were returned (Chi-square(1,1858) = 1.1706, n.s.). It does not seem as if the numbering of the surveys lowered the return rate.

Table 2. contains additional information about respondents, especially in regards to some of the characteristics of their information environment. One result of the data that was surprising is the number of respondents who replied that they had begun a "substantially new line of research investigation in the past two years." It may be that the campus information environment plays a particularly crucial role for researchers who change the focus of their research. This desires much greater study.

Part I of the *Faculty at Work* questionnaire, "Work Environment," has four sections. The first section (ENVIRONMENT A) contains general statements about the environment in which the respondent works, i.e. the institutional environment as a whole and the collegial environment in the faculty member's

TABLE 2. SELECTED PERSONAL DATA FROM MAIN STUDY RESPONDENTS

1.	The average number of years spent at this institution was 14.7, with a range from .5 - 40 years		(n=833)
2.	The year in which the highest degree was awarded ranged from 1946-1993.		(n=708)
3.	The year in which respondents were born ranged from 1920-1966.		(n=820)
4.	75.5% were tenured; 24.5% untenured.		(n=833)
5.	Native American	0.6%	
	Hispanic/Mexican American	1.4%	
	Asian	2.3%	
	African American	2.7%	
	Caucasian	92.8%	(n=823)
6.	55.2% had started a substantially new line of research investigation in the past two years.		(n=842)
7.	94.8% had an office supplied for their sole use by the institution.		(n=848)
8.	74.9% had a computer supplied for their sole use by the institution.		(n=847)
9.	26.2% had some level of administrative appointment ranging from 2% to 100%.		(n=840)

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10. Use of software:

	Considerable		Not Supplied		
Spreadsheet	14.0	%	39.5	%	(n=826)
Word Processing	61.2	%	23.2	%	(n=832)
Statistical	17.4	%	40.2	%	(n=823)
Communications	21.0	%	36.5	%	(n=819)
Desktop Publish.	8.7	%	16.0	%	(n=266)

11. Estimates of the number of volumes held in personal collections both at home and in the office ranged from 0 to 8500, with a mean = 547. (n=801)

12. Estimates of the number of file drawers full of articles and photocopies ranged from 0 to 1000 with an median of 4 drawers. (n=831)

13. Estimates of personal journal subscriptions ranged from 0 to 44, with a mean = 5.7 subscriptions. (n=838)

14. Estimates of the percentage of personally held photocopies from items in the university's library ranged from 0% to 100% with a mean = 37%; median = 20%. (n=809)

15. Hours of student assistance per week ranged from 0 to 396* with a mean = 13.7; median = 0 hours weekly. (n=811)

own unit. The second section (ENVIRONMENT B) asks each respondent to first rate his/her satisfaction with his immediate administrator and then the next higher level administrator on a set of personal attributes related to effectiveness. The Campus Information Environment questions (INFORMATION ENVIRONMENT) were added to this section of the questionnaire since Blackburn and Lawrence's model proposes that information is part of the overall work environment.

Work Environment also concerns the perceived response of the environment in recognition of faculty accomplishments (ENVIRONMENTAL RESPONSE). The fourth section of this part of the questionnaire measures the perception of self-efficacy (SOCIAL KNOWLEDGE) of the respondent within the Work Environment, as she evaluates whether she can influence what happens to others and to herself.

Part II of the questionnaire consists of three sections. The first is a set of phrases describing attributes of a "valued" faculty member. The respondent rates a valued faculty member in their own unit and then rates him/herself on the same dimensions related to personal characteristics (SELF-KNOWLEDGE1 and SELF-KNOWLEDGE2). Section 2 consists of a list of circumstances outside of work (SOCIAL CONTINGENCIES) that affect one's ability to do research. Section 3 is a list of "Scholarly Activities" that have traditionally been assumed to be related to

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scholarly publication, such as making presentations about research, etc.

Attempts to identify factors comprising variables in the theoretical model used in *Faculty at Work* have previously been made using regression techniques. However, regression may be inadequate to satisfactorily analyze the role of latent variables when the factors comprising the theoretical variables have been identified initially only through principal components factor analysis. Principal components factor analysis relies on the occurrence of correlation among the data elements within the sample supplied for analysis. It can not account for measurement error and it can be subject to chance correlations or be totally confounded by the lack of strong correlations. Results may be unreliable and inhibit the development of variables that provide adequate discriminate validity to identify theoretical constructs.

Therefore Confirmatory Factor Analysis (CFA), using LISREL 7, was used in this study to verify the structure of latent variables which serve as the theoretical basis for the *Faculty at Work* model. CFA provides a means of further testing structure within the data, separating out measurement error from the relationships among measured variables and latent variables. Rather than capitalizing on chance correlation among variables, CFA uses analysis of variance/covariance matrices to analyze whether the data confirms the theoretical construct.

Evaluation of the "goodness-of-fit" of confirmatory factor analysis output is often made through the c^2 test, but a c^2 test is adversely affected by large sample sizes. Therefore, other diagnostics are also useful. In this study the Comparative Fit Index (CFI), proposed by Bentler[15] as a normed index, ranging between 0.0 and 1.0, based on the degrees of freedom in the hypothesized model and the null model was used as the primary Goodness-of-fit criterion. Generally, CFI values greater than .90 are considered to indicate adequately fitting models. Once a model achieves a CFI of .9 or better, modification should cease since any further improvement is likely to occur from capitalizing on chance relationships within the data.

Results for the confirmatory factor analysis of the study data are summarized in Table 3. These factors were then used in a structural equation

TABLE 3. CONFIRMATORY FACTOR ANALYSIS RESULTS

Factors Composing Theoretical Variables	CFA Results
1. Work Environment.	

ENVIRONMENT A
Rewards and Trust — CFI=.94
Faculty Committed to Teaching
Collegial Support for Individual's Research

ENVIRONMENT B
Immediate supervisor — CFI=.97
Administrator two levels higher

INFORMATION ENVIRONMENT
Enjoyment/Use of Technology — CFI=.92
Access to Research Resources
Computer/Software Support
Personal Information Environment
Telecommunications Environment
Help from Librarians

ENVIRONMENTAL RESPONSE
Other Rewards — CFI=.91
Salary/Promotion

SOCIAL KNOWLEDGE
Departmental Affairs — CFI=.93
Research

II. Personal Characteristics

SELF-KNOWLEDGE1
Interpersonal Skills — CFI=.88
Active Researcher
Public Work Ethic
Communicates/Organized
Competitive/Ambitious
Personal Work Ethic

SELF-KNOWLEDGE2
Interpersonal Skills — CFI=.82
Active Researcher
Values Work over Homelife
Works Hard/With Humor
Personal Integrity
Competitive/Ambiti[illegible]

SOCIAL CONTINGENCIES
Child Care — CFI=.93
Other

modeling process to test the statistical significance of the theoretical constructs on publishing productivity.

"INFORMATION ENVIRONMENT" is the section of the questionnaire developed solely by this investigator. Items in this section were based upon both research and "common wisdom" in the field of library and

information studies concerning the use of information stores and channels, personal information gathering strategies, the role of technology in providing access to scholarly information, and the role of librarians in supporting the scholarly enterprise.

The latent variables that emerged for the campus information environment were: "Enjoyment/Use of the Computer and Software"; "Access to Research Resources"; "Computer/Software Support"; "Personal Information Environment"; "Telecommunications Environment"; and "Help from Librarians."

It is interesting to note that one question, i.e. "Access to specialized software or hardware provided by the university for my research meets my needs," loaded on two factors. As indicated by the data structure in this survey, the answers to this question were related to both "Access to Research Resources" and "Access to Basic Computers/Software." This may indicate that another important factor related to specialized information processing tools of some other sort "lurks" between factors related to the provision of basic computer/software and basic library support. Or it may indicate the perception that the role of library in offering access to electronic databases for research is a significant and growing part of the how faculty define "research resources." Both these interpretations should be explored in future versions of the questionnaire.

SOCIAL CONTINGENCIES was the final section of the main study analyzed. Analysis led to a two-factor model that identified "Child care" and "Pregnancy/New child" as loading on one unique factor with all other contingencies forming one "Other" factor. One particularly interesting outcome of this study is that the factor "Other" had a positive sign associated with it. It may be the case that social contingencies actually promote publication in some instances, perhaps through providing a rewarding work related outlet for personal stress. "Child care" however, is a negative factor.

Structural Equation Model

Factors based on the CFA segment of the study were added, one construct at a time, to a LISREL 7 structural equation modeling program to test whether the constructs fit the model. Six iterations of the model were run beginning with Social Knowledge constructs. In addition to the theoretical constructs certain directly measured variables that had proved statistically significant in a regression analysis portion of the study were also added. Seven directly measured items related to common academic activities from the questionnaire that proved statistically

related to faculty publishing productivity were: Prior publication rate (PRIOR); Submission of a scholarly article (SUB); Presentation (PRESENT) of ongoing work on campus or at a professional meeting; Writing a research report (REPT); Current research activity (RSCH) which is the sum of the answers to two questions about how many journal editorial boards one serves one and for how many journals one reviews submissions; Number of articles reviewed in the past two years (REVIEW); Submission of a proposal for a monograph (MONO); and Career grants activity (GRANTS). Additionally, the environmental variables realted to the number of journal articles (FILE) in one's office and hours of student research assistance (STUD) available for the faculty member also proved to be significantly related to publication. These variables were also added to the structural equation.

The results for the model that includes campus information environment constructs and directly measured variables as well as some theoretical constructs is shown in Table 4.

The model produced in this iteration illuminates the role of the Information Environment in publishing productivity and identifies some interesting areas for further research. Overall, the information environment variables are mixed in their effect on other variables. And not all the information variables contribute positively to publishing.

Standardized parameter estimates for INF equal to or greater than ± 0.02 were achieved in the fifth structural equation for:

INF1 (-0.02) - Enjoyment/Use of Technology;

INF2 (0.04) - Access to Research Resources;

INF3 (-0.06) - Computer/Software Support;

INF4 (-0.14) - Personal Information Environment;

INF5 (0.13) - Telecommunications Environment; and

INF6 (0.05) - Help from Librarians.

INF1, INF3, and INF4 have negative signs in the structural equation. INF1 (Enjoyment/Use of Technology) may indicate that people who enjoy computers and software are not necessarily those who have higher publication rates. Neither are those who seek personal computer/software support (INF3) or who are constantly active in acquiring large personal information stores (INF4) those who publish more than their colleagues. Caution must be used in

making predictive inferences since the results were not statistically significant.

TABLE 4 LISREL SOLUTION FOR FIFTH STRUCTURAL EQUATION

Variable:	PRIOR	RSCH	SUB	PRES	REV
Dir. Eff.	0.17	0.32	0.68	0.12	-0.01
Std. Error	(0.11)	(0.10)	(0.10)	(0.06)	(0.02)
T-Value	1.54	**3.28**	**6.48**	1.90	-0.30
Std. Value	0.08	0.20	0.54	0.15	-0.02

	MONO	GRTS	FILES	STUD	REPT
Dir. Eff.	0.05	0.07	0.01	0.00	-0.21
Std. Error	(0.20)	(0.02)	(0.03)	(0.01)	(0.06)
T-Value	0.24	**3.47**	0.28	-0.38	**-3.54**
Std. Value	0.01	0.17	0.02	-0.02	-0.24

	SOC1	SOC2	RESP1	RESP2	CONT1
Dir. Eff.	-0.16	0.26	-0.01	-0.01	-1.07
Std. Error	(0.54)	(0.62)	(0.13)	(0.32)	(0.96)
T-Value	-0.29	0.41	-0.07	-0.04	-1.12
Std. Value	-0.03	0.04	0.00	0.00	-0.11

	CONT2	INF1	INF2	INF3	INF4
Dir. Eff.	0.28	-0.05	0.34	-0.33	-1.21
Std. Error	(0.73)	(0.12)	(0.75)	(0.46)	(2.00)
T-Value	0.39	-0.39	0.45	-0.72	-0.61
Std. Value	0.04	-0.02	0.04	-0.06	-0.14

	INF5	INF6
Dir. Eff.	0.88	0.28
Std. Error	(0.59)	(0.33)
T-Value	1.50	0.85
Std. Value	0.13	0.05

Error Variance for the Structural Equations = 17.49 (1.63)

10.74

Squared Multiple Correlation for Structural Equations = 0.59.

The data suggest that if university administrators are interested in stimulating publication active support of faculty who like to experiment with hardware and software is not all that is required. Expanding unmediated

browsability of information resources or direct subsidization of personal information stores is not sufficient either.

What seems to be required is faculty support of a different sort. Basic investment in research resources and the telecommunications environment and support from information professionals seem to be positively linked faculty publishing productivity. These factors bear further investigation and refinement by other researchers. But if these initial findings are substantiated it might suggest that library budgets, the campus telecommunications infrastructure and expanded individualized support from information professionals would be candidates for priority investment by university administrators.

Each of these factors should be explored further by other researchers and the findings of this study should be confirmed on another data set. However, this study serves as a good beginning in the identification of the role of campus information environment variables in publishing productivity.

ENVA, ENVB, KNOW1 and KNOW2 were in turn added to the structural equation in place of INF. They were not added to the equation in addition to INF because adding more variables to the model resulted in a situation in which the sample size was smaller than the number of parameters being estimated.

Non-significant standardized estimates equal to or greater than 0.05 for direct effects on publishing were achieved for SOC1, SOC2, CONT2 and ENVB2 (this value has a negative sign) in the sixth structural equation shown in Table 5. These results substantiate Blackburn and Lawrence's work in developing Social Knowledge, Social Contingencies, and Work Environment constructs. However,

the results indicate that the subdimensions" of the constructs identified in this study may be first-order latent variables in their own right rather than

TABLE 5. LISREL SOLUTION FOR FINAL STRUCTURAL EQUATION

Variable:	PRIOR	RSCH	SUB	PRES	REV
Dir. Eff.	0.21	0.27	0.63	0.15	0.00
Std. Error	(0.09)	(0.09)	(0.07)	(0.05)	(0.02)
T-Value	**2.29**	**2.97**	**9.62**	**2.84**	0.08
Std. Value	0.10	0.17	0.51	0.18	0.00
	MONO	GRTS	FILES	STUD	REPT
Dir. Eff.	0.10	0.07	-0.01	0.00	-0.23
Std. Error	(0.15)	(0.02)	(0.02)	(0.01)	(0.01)
T-Value	0.67	**3.66**	-0.41	0.05	**-4.12**
Std. Value	0.03	0.17	-0.02	0.00	-0.26

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	SOC1	SOC2	RESP1	RESP2	CONT1
Dir. Eff.	-0.58	0.64	0.02	-0.07	-1.63
Std. Error	(0.38)	(0.54)	(0.13)	(0.26)	(0.75)
T-Value	-1.53	1.19	0.18	-0.27	**-2.17**
Std. Value	-0.12	0.10	0.01	-0.01	-0.17

	CONT2	ENVB1	ENVB2
Dir. Eff.	0.76	0.05	-0.25
Std. Error	(0.58)	(0.17)	(0.19)
T-Value	1.32	0.27	-1.31
Std. Value	0.12	0.01	-0.05

Error Variance for the Structural Equations = 17.86 (1.49)

11.98

Squared Multiple Correlation for Structural Equations = 0.58.

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components of a second-order latent variable. No results were obtained when SELF-KNOWLEDGE variables were added which was probably due to the lack of clearly formed factors as determined by the low Comparative Fix Index values obtained in the Confirmatory Factor Analysis process.

The values obtained in each of the structural equations in Tables 4 and 5 are parameter estimates, dis-attenuated by error. The size of the respondent pool and the good-fit of the measurement models for each latent variable suggest that the data are clean and coherent. Modifications to Blackburn and Lawrence's framework based on these results should be investigated for other research universities.

Conclusions

The data reported herein confirm and refine many of the latent variables identified by Blackburn and Lawrence which are used as the basis for their theoretical framework and the *Faculty at Work* questionnaire. To the extent that the factors discussed in their work map closely to those confirmed in this study, their conclusions about the role these factors play in faculty productivity are supported. The factor structure identified in this study may provide an even stronger basis for future analysis of the role these variables play in faculty publishing productivity.

The factor structures of "Social Contingencies" and the "Campus Information Environment" were newly identified in this study. The results obtained indicate that several social contingencies may have a positive effect of

publishing productivity. The reasons for this should be investigated more thoroughly, but preliminary results indicate that publication, as it is linked to higher salaries, promotion or getting a new job, is a productive outlet for the pressures of life. "Child care," however, seems to require that "attention," which some have called the scarcest resource of the 1990's, be diverted away from work. It seems to be a contingency that truly inhibits productivity.

Further research on the role that campus information environment factors play in faculty publishing productivity should definitely be undertaken. The factors identified in this study seem to indicate that computing support, including software and electronic resources accessed through telecommunications, is comprised of discernible factors that can be linked to productivity in the workplace as well as factors such as support of librarians and access to more traditional types of specialized research resources.

The relationship of variables traditionally associated with publishing, such as submitting articles, serving on editorial boards, writing grants, and one's prior publication record was statistically established. The finding that report writing relates negatively (and significantly) to publication may suggest further research on publication as a cyclical activity, with natural lulls as work on grants requires that results be put into reports but does not yet allow for publication of those same results. It may be useful to begin a systematic exploration of the role of information environment variables in the support of these precursors to faculty publication. It may also be fruitful to study the role all of the factors identified in this study play in support of other valued faculty behaviors such as teaching and grantsmanship. Further study of the role that the information environment plays in supporting faculty who wish to substantively change their focus of research is definitely warranted.

The identification of variables related to faculty life and verification of the factor structure comprising these variables is essential in promoting work environments that foster creativity and productivity. A better understanding of the faculty workplace is highly desirable an age of wide-spread accountability for the expenditure of public dollars in higher education. It may be absolutely essential if higher education is to be able to assume a significant role in society's growing information economy. This study has served as an initial foray into the greater depth of analysis needed in this area.

This study is based on the author's Ph.D. dissertation, University of Michigan (1996). Permission to use the Faculty at Work survey is gratefully acknowledged as is the advice of all members of my committee, including especially Robert T. Blackburn. A version of the questionnaire is also included in: Blackburn, Robert T. and Lawrence, Janet H. Faculty at work. Baltimore, The Johns Hopkins University Press, 1995.

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